ILLINOIS WATERWAY, LOCKPORT LOCK, DAM AND POWER HOUSE
2502 Channel Drive
Lockport
Will
Illinois

HAER IL-164-H
IL-164-H

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

REDUCED COPIES OF MEASURED DRAWINGS

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
U.S. Department of the Interior
1849 C Street NW
Washington, DC 20240-0001

HISTORIC AMERICAN ENGINEERING RECORD

ILLINOIS WATERWAY, LOCKPORT LOCK, DAM AND POWER HOUSE

HAER No. IL-164-H

Location:	2502 Channel Drive, Lockport, Will County, Illinois, on Chicago Sanitary and Ship Canal Latitude: 41.5715444, Longitude: -88.0778750
Present Owner:	U.S. Army Corps of Engineers; Metropolitan Water Reclamation District of Greater Chicago
Present Use:	Navigation of Illinois Waterway
Significance:	The Lockport Lock, Dam and Power House is significant both for its role in navigation of the Chicago Sanitary and Ship Canal and the Illinois Waterway and for the vertical lift lock gate at the upstream end of the lock. At the time of its construction (1923-33), the vertical lift gate was reportedly the highest of its kind in the world and may be the only one of its kind still in operation according to a 1996 inventory and 2001 National Register nomination.
Historian:	Justine Christianson, HAER Historian, 2008
Project Information:	The Illinois Waterway Recording Project (2007-2008) is part of the Historic American Engineering Record (HAER), a long-range program to document historically significant engineering and industrial works in the United States. HAER is administered by the Heritage Documentation Programs, a division of the National Park Service, U.S. Department of the Interior, Richard O'Connor (Acting Manager). The U.S. Army Corps of Engineers (USACE) funded the project. Ron Deiss, USACE, and Dana Lockett, HAER Architect, served as project managers. Dana Lockett and Anne Kidd produced the measured drawings. Large format photography was done by Brian Grogan. Justine Christianson wrote the historical reports. Research assistance was provided by John Fitzgerald, Archivist, USACE.

Part I. Historical Information

A. Physical History:

1. **Date of Construction:** (1905-07; 1922-33)
The Lockport Lock, Dam and Power House site was built during two distinct phases of development. The first phase dates to the 1905-07 extension of the Chicago Sanitary and Ship Canal, in which the original lock, along with a tail race, guidewalls, forebay, sluice gate and power house were constructed. The Ohio River Standard Navigation lock, control station and various auxiliary structures associated with that lock date to the second phase of construction at the site, which occurred as part of the building of the Illinois Waterway from 1922-33.[1]

2. **Architect/Engineer:**
Isham Randolph, Chief Engineer of the Chicago Sanitary District who oversaw the extension of the Chicago Sanitary and Ship Canal, designed the original lock, tail race, guide walls, forebay, and sluice gate. Frederick L. Barrett designed the power house.[2]

Engineers with the State of Illinois designed the Ohio River Standard Navigation lock, and state engineer Walter M. Smith designed the control station. The Illinois Division of Waterways initially oversaw the construction at Lockport. M.G. Barnes served as the division's Chief Engineer, while Walter M. Smith was the Chief Designing Engineer. At Lockport, R.S. Heath served as Resident Engineer with assistance provided by Fred Hendershot.[3]

3. **Builder/Contractor/Supplier:**
Contractors Joseph J. Duffy and the Lorimer & Gallacher Company, both of Chicago, built the original lock, dam, tail race and guidewalls.[4]

Green & Sons Company of Chicago built the later Ohio River Standard Navigation lock, with Roy Shackelton as General Superintendent, C.C. Green as Superintendent, and R.A. Bonnell as Engineer.[5]

Schmidt Brothers Construction Company built the control station.[6]

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[1] Mary Yeater Rathburn, American Resources Group, Ltd., "Architectural and Engineering Resources of the Illinois Waterway between 130th Street in Chicago and La Grange," Volume 2, prepared for U.S. Army Corps of Engineers, Rock Island District, Rock Island, Illinois, October 1996, pp. 41-104.
[2] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 41-52.
[3] Mary Yeater Rathburn, American Resources Group Ltd., "Architectural and Engineering Resources of the Illinois Waterway between 130th Street in Chicago and La Grange, Illinois," Volume 1, prepared for the U.S. Army Corps of Engineers, Rock Island District, Rock Island, Illinois, October 1996, p. 87, and Volume 2, pp. 53-54; "Lockport Lock Construction Plant, Illinois Waterway," *Engineering News-Record* 96, no. 6 (February 11, 1926): p. 231.
[4] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 1, p. 53.
[5] "Lockport Lock Construction Plant," p. 231.

Specific names of the contractors involved with construction of the site once the Army Corps took over have been identified when known in the construction section of this report.

4. **Original Plans:**
According to the 1930 Army Corps' publication, "The Illinois Waterway," the State of Illinois designed an Ohio River Standard Navigation lock measuring the standard 110' wide x 600' long with a 41' lift and depths of 22' and 16' on miter sills.[7] The upstream end had two vertical lift gates measuring 20' high and weighing 190 tons each. The counterweights for the gates were located in towers flanking the lock chamber and connected by overhead bracing. Enclosed shelters were located at the top of each tower and at the midpoint of the overhead bracing, as revealed in a 1928 photograph. The downstream end of the lock had miter gates measuring 60' high and weighing 315 tons apiece. Within the reinforced concrete lock walls were 12' diameter culverts with lateral conduits extending out from the culvert into the chamber. The openings of these conduits were spaced at regular intervals just above the lock floor and were used to water the chamber.[8]

A U.S. Army Corps of Engineers drawing from 1935 shows the layout of the site. To the west is the power house with eight turbine chambers and an "inclosed bay" to the north bounded by fender and retaining walls and the tail race to the south. Adjacent to the power house is the dam with 12' and 48' gates. Curved walls guide the water into the tailrace. Next to the dam and power house is the original lock with miter gates and immediately adjacent to that is the lock built for the Illinois Waterway.[9]

5. **Alterations and Additions:**
Alterations have been made to the site over its operational history. These include the replacement in 1967 of one of the original vertical lift gates located at the Illinois Waterway lock's upstream end. In 1984, corrugated metal buildings were constructed to house the cables operating the vertical lift gate as part of a $22.7 million dollar rehabilitation of the site. The buildings replaced the original tower and overhead bridge configuration. The bear trap dam located between the powerhouse and original lock underwent alteration sometime after 1986. The 48' bear trap gate located closest to the original lock was removed and replaced with a

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[6] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, p. 55.
[7] According to the U.S. Army Corps, Rock Island District, the lift at the lock is actually 39'. Other early sources record the lift as 41', including M.G. Barnes, "The Illinois Waterway," *Journal of the Western Society of Engineers* XXVI, no. 5 (May 1921): p. 176 and "The Illinois State Waterway for Barge Navigation," *Engineering News-Record* 85, no. 23 (December 2, 1920): p. 1096. Rathburn, however, states the lift is 40' in Volume 2, p. 53.
[8] U.S. Army Corps of Engineers, "The Illinois Waterway," (Washington, DC: U.S. Government Printing Office, 1930), p. 43. See photograph number 14376, dating to September 30, 1928, which is available at Lockport Lock and Dam site.
[9] U.S. Engineer Office, Chicago District, Joliet Area, "Illinois Waterway, Lockport Lock, Topography," December 1935, available at U.S. Army Corps of Engineers, Rock Island District.

20' motorized vertical lift sluice gate centered in the 48' opening and concreted in place. The 12' bear trap sector gate located near the power house was also dismantled and the opening concreted. A flight of concrete stairs on the downstream side of the dam provide access from the ground floor of the powerhouse to the top of the dam.[10] A major rehabilitation took place in June 1995 of the entire waterway, which was shut down for sixty days to resurface the walls of the lock chambers and repair and replace the lock gates as necessary.[11] Buildings have been removed from the site as well. These include two sheds, which were originally located to the north of the garage and removed sometime after 1996, and the lockkeepers' houses, which were originally located south of the control station and replaced by a maintenance building sometime after 1996.

B. Historical Context:

Chicago's increasing population in the nineteenth century resulted in a corresponding increase in the amount of sewage being released into the Chicago River and contaminating not only the river but also Lake Michigan, from which the city drew its drinking water. Installing pumps where the Illinois and Michigan Canal joined the Chicago River and lowering the level of the canal from 1866-71 did little to mitigate the problem. In 1889, the State of Illinois authorized the establishment of the Sanitary District of Chicago to deal with the sewage problem.[12] The Chicago Sanitary District undertook construction of the Chicago Sanitary and Ship Canal in September 1892 for the purpose of diverting water from Lake Michigan to dilute and carry the city's sewage away from the lake. Isham Randolph, Chief Engineer, and his successor in July 1907, G.M. Wisner, Consulting Engineer, oversaw the project.[13]

A 1903 law allowing the generation of power on the canal resulted in its extension nearly 2 miles to Lockport, where two movable dams, a lock and a power house were constructed following the design of Isham Randolph. The lock is similar to those built on the Hennepin Canal by the Army Corps of Engineers from 1905-10.[14] The power

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[10] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 1, p. 104 and Volume 2, p. 53; Barbara J. Henning, "Lockport Lock, Dam and Powerhouse Historic District," National Register of Historic Places Nomination Form, 2001, Section 7, Page 5.

[11] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 1, p. 105 and Volume 2, p. 53.

[12] W.C. Weeks, "The Illinois Waterway," *The Military Engineer* 24, no. 135 (May-June 1932): p. 231.

[13] Estimates for the cost of the canal vary widely, from $59,566,000 to $75 million to $80 million. See W.G. Gude, "Illinois Waterway is Now Completed: Final Link in Lakes to Gulf System," *Marine Review* 63, no. 6 (June 1933): p. 19; "Preliminary Examination and Survey and Review of Reports on the Calumet-Sag Channel (1931-33)," p. 4, in Folder 800.921, File #2, in Record Group 77, U.S. Army Corps of Engineers, Chicago District, National Archives and Records Administration, Great Lakes Region-Chicago (hereafter cited as RG 77, NARA, Chicago); U.S. Congress, House of Representatives, "Hearings before Subject of the Improvement of Illinois Waterway (Calumet, Little Calumet River, and Sag Channel Section), Illinois," (Washington, DC: U.S. Government Printing Office, 1934), p. 1.

[14] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 1, p. 53; Edward Wegmann, *The Design and Construction of Dams Including Masonry Earth, Rock-Fill, Timber and Steel Structures. Also the Principle Types of Moving Dams* (New York: John Wiley & Sons, 1922), pp. 363-363. See Figure 119 for a section through the dam.

house allowed the Sanitary District to earn some additional revenue by selling the electric power generated and "reflected turn-of-the-century attitudes toward river improvements, that such costly undertakings should yield multiple benefits to the public."[15]

The Illinois Waterway plans called for building an Ohio River Standard Navigation lock measuring 110' x 600' adjacent to the Sanitary District's lock. The Lockport lock site was slightly different from the other sites along the waterway designed by the State of Illinois, partly because it was planned two years before the rest of the system and partly because the site had the highest lift. Rather than having miter gates at both ends, the lock was designed with two single-leaf, vertical lift, cable-driven gates at the upstream end. The vertical lift gates resembled those at Keokuk, Iowa on the Upper Mississippi River, which were designed by Hugh L. Cooper in conjunction with Rock Island District Engineer Montgomery Meigs from 1908-14.[16] Construction at the site by the Illinois Division of Waterways began in 1923.

The U.S. Army Corps of Engineers assumed authority over the partially built Illinois Waterway in 1930 and completed Lockport, estimated to be 97 complete at the time of the transfer of authority, in time for the waterway's opening in 1933.[17]

Part II. Structural/Design Information

A. General Description:[18]

Located on the Chicago Sanitary and Ship Canal, the site consists of a power house, dam, two locks, and various associated structures. The power house, tail race, forebay and dam are operated by the Metropolitan Water Reclamation District of Greater Chicago. The Army Corps-controlled portion of the site consists of the two locks, a control station, mooring piers, various buildings and machinery related to the operation of the lock, tow haulage units, and garage.[19]

At the western edge of the site is the Beaux-Arts power house, designed by Frederick L. Barrett. The building was constructed from concrete blocks laid to simulate stone. The main section of the power house measures 385' x 70'. The symmetrical south facade (the main one) is divided into ten bays by pilasters. Each bay consists of three

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[15] Henning, "Lockport Lock, Dam and Powerhouse," Section 8, Page 6; Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 1, p. 53; Weeks, p. 231.
[16] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 1, p. 70.
[17] Estimated completion given in caption of a Fairchild Aerial Survey photograph from May 3, 1931 that ran in the *Chicago Sunday Tribune*. Photograph available at Lockport Lock and Dam.
[18] Building descriptions are based on field work conducted by the HAER recording team in 2007-2008 and the inventory completed by Mary Yeater Rathburn and the American Resources Group, Ltd. in 1996, pp. 41-104.
[19] The dam, both locks, power house and control station have been determined contributing resources to the historic district, while the auxiliary structures like the control stands, garage, and machine buildings have been determined noncontributing. See Barbara J. Henning, "Lockport Lock, Dam and Power House Historic District," National Register of Historic Places Nomination Form, 2001, Section 7, Page 1.

arched windows on the bottom and three windows on the upper floor. The water intakes with various gate types (sluice, miter, and butterfly) are located on the north facade, which is largely submerged and further obscured by a parking deck. The machinery used within the power house has changed since its initial 1905-1907 construction due to a 1930 Supreme Court ruling reducing the amount of water that could be diverted from Lake Michigan for the Chicago Sanitary and Ship Canal. Originally horizontal Francis-style turbines were located in the power house, but four of those were replaced by two vertical Kaplan-style turbines. The power generated at the site was sold to Commonwealth Edison of Joliet and the nearby Illinois State Penitentiary.[20]

The triangular forebay, located north of the powerhouse, supplied water to the power house. The forebay is formed by a retaining wall to the northwest, a 450' reinforced concrete fender wall to the east, and the dam and power house to the south. The fender wall sits on a series of sixteen arches, which facilitated water movement and prevented ice from forming on the gates of the water intakes and the 12' bear trap dam gate. This design was later used by the Army Corps in the river walls of the locks constructed on the Upper Mississippi River.[21]

To the south of the power house is the nearly 1,000' long tail race and guidewall of reinforced concrete and dirt that extends from the river wall of the original lock and turns northwest to the power house, forming a triangular median at the downstream end. The wall helped barge traffic maneuver through the original lock and mitigated outdraft produced by water flowing through the power house and the two dam gates.[22]

The upstream lock guidewall is nearly 150' long and is made up of a series of concrete arches at the bottom with a solid wall on top, much like the nearby fender wall. The arches facilitated water flow and prevented icing. This guidewall also helped the "barge traffic counteract outdraft" produced by the dam gates and power plant intakes.[23]

The dam is located between the power house and the Chicago Sanitary and Ship Canal lock and was built for "regulating the flow in the canal when the power-plant is using only part of the water, and to carry office and floating objects that may collect in the forebay."[24] The 120' long concrete structure consists of a 70' long pier dam and a 50' stationary dam. The survey produced by Mary Yeater Rathburn and the American Resources Group classifies it as a bear trap dam while the 1922 publication entitled *The Design and Construction of Dams, Including Masonry, Earth, Rock-Fill, Timber*

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[20] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 1, p. 83 and Volume 2, pp. 41-42, 57-60; Henning, "Lockport Lock, Dam and Power House Historic District," Section 7, Pages 3-5.
[21] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 43-44.
[22] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 47-48; Henning, "Lockport Lock, Dam and Power House Historic District," Section 7, Page 2.
[23] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 51-52.
[24] Wegmann, *Design and Construction of Dams*, p. 364.

and Steel Structures, Also the Principal Types of Movable Dams by Edward Wegmann classifies it as a movable sector dam that operated much like a bear trap dam. The pier dam originally had a 48' wide sector gate located near the original lock, followed by a 10' wide pier, and then a 12' wide sector gate adjacent to the power house. A Beaux Arts pier house atop the dam contained the controls used to operate the gates.[25] The design for the sector gates was modeled after that by Josiah White in 1818 in which the gate had a curved "face" connected by triangular trusses to an axle running the full length of the gate on which the gate rotated. Wegmann described the 48' wide sector gate as equaling a 45 degree sector of a horizontal cylinder with a vertical range of motion of 18'. The 48' wide gate regulated the level of water in the forebay and the flow of water in the canal. The concrete tail race wall extended from the end of the lock guidewall and directed the water flowing through the 48' wide sector gate into the tail race. The 12' wide sector gate was similar in design to the 48' wide gate and aided in "discharging the material raked from the screen racks at the intakes to the wheel-pits, and, also, submerged floating debris."[26] Both gates were removed post-1986 and a 20' vertical lift sluice gate was installed in the original 48' gate opening while the 12' gate opening was concreted closed.[27]

The original lock has a 22' x 130' chamber with concrete walls and wood miter gates at both the upstream and downstream ends. It has a 34' lift. The lock was rendered obsolete by the completion of the Illinois Waterway in 1933.[28] (See Appendix A, Figure 1)

The 1933 Ohio River Standard Navigation lock is located next to the original lock. It has a 110' x 600' chamber and a 39' lift, making it the highest on the waterway. Single-leaf, vertical lift main and emergency steel gates operated by cables are located at the lock's upstream end while steel miter gates operated by electric motor assemblies are located at the downstream end. The chamber is watered by rectangular ports located along the bottom of each lock wall that extend from the 12' diameter culvert that runs through the interior of each chamber wall. Four valves operated by hydraulic machinery regulate the flow of water through the culverts.[29]

Structures that date to the opening of the Illinois Waterway include the control station and garage. The control station is prominently situated at the center axis of the lock. It is identical to those at Brandon Road, Dresden Island, Marseilles, and Starved Rock. The 988 square foot, one story, cross gabled brick building with concrete detailing and four belt courses functions as "the administrative and operational hub" of the site. Metal industrial sash windows provide the crew with views of the lock chamber and waterway. The gable roof was originally tiled but has since been replaced by shingles.

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[25] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 45-46.
[26] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 1, pp. 56-57; Wegmann, *Design and Construction of Dams*, p. 362.
[27] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 45-46.
[28] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 49-50.
[29] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 53-54.

A metal plaque commemorates Mortimer Grant Barnes, Chief Engineer of the state's Division of Waterways who was in charge of the design and construction of the facility, and the opening of the lock on June 22, 1933.[30] The other original building is the 1933 two car garage located at the northern end of the site. The approximately 540 square foot, one story, wood frame building has undergone some alterations, namely the replacement of the garage doors and the installation of vinyl siding.[31]

Auxiliary buildings relating to the maintenance and operation of the lock include the paint and work sheds, which were constructed in the 1940s and removed sometime after 1996. Both buildings were located north of the garage. The paint shed was a 160 square foot, one room, one story wood frame building clad in metal that was similar to those at Dresden Island, Starved Rock and the Illinois Waterway Project Office. The work shed was a 384 square foot, one room, one story wood frame building with wood cladding. Both buildings were located north of the two car garage.[32] A weatherproof metal cabinet dating to the 1960s is located on the riverwall of the lock and contains the controls, fuses, and circuit breakers providing electrical power.[33] In 1984, two one story, metal buildings were built to house the machinery for the air bubbler system, which was necessary to keep the lock gates operable even in freezing conditions.[34] A one room, one story wood building located just south of the control station was built around 1990 to house the electric scooters used by the lock crew.[35]

In addition, various alterations were made to the lock itself and its operating equipment. In the 1940s, six cylindrical reinforced concrete piers with mooring bits embedded in them were built at the upstream end of the canal just outside the lock. These provided places for crews to tie their boats while waiting to be locked through.[36] Another change occurred in the 1960s when the original machinery used to operate the valves in the lock's chamber walls was replaced with hydraulic machinery. Originally, the valve operating machinery had been housed in wells sunk within the lock walls, but the new hydraulic machinery was housed in metal cases located at each end of the lock chamber. Identical machinery was also installed at Brandon Road, Dresden Island, Marseilles, and Starved Rock.[37] After the removal of the machinery, the wells were converted into storage spaces with the addition of walls and roofs. This modification was also made at Brandon Road, Starved Rock, and Marseilles.[38] Replacement tow haulage units were installed in the 1970s. Consisting of three

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[30] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 55-56; Henning, "Lockport Lock, Dam and Power House Historic District," Section 7, Page 4.
[31] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 103-104.
[32] Although both sheds were described in Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 63-66, fieldwork conducted for this project in 2007-2008 reveals the two structures had been removed.
[33] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 71-72.
[34] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 91-94.
[35] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 101-102.
[36] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 61-62.
[37] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 73-74.
[38] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 67-70.

identical motorized winch assemblies, the units pull barges into and out of the lock, making "it possible to lock large modern units through without repeatedly detaching tow from the barges immediately in front of it." The Army Corps installed these at Brandon Road, Dresden Island, Marseilles, Starved Rock, Peoria and La Grange as well as on the Upper Mississippi River.[39]

Four control stands, also known as "dog houses," were built from 1982-83 at each corner of the lock chamber to hold the switches operating the valves and gates. The 52 square foot, one room, one story, metal buildings have large windows on all four sides to provide operators with unobstructed views of the lock chamber.[40] The cables used to operate the single-leaf vertical lift main and emergency gates are housed in four one-story, metal buildings built in 1984 that replaced the original towers connected by an overhead bridge.[41]

B. Construction:

The State of Illinois contracted Green & Sons Company to build the lock at Lockport and work began in October 1923. The contract specified building parallel gravity-section lock walls measuring 938' long, 110' apart, and 66' tall. As described in a 1926 article in the *Engineering News-Record*, building the lock required 171,000 cubic yards of excavation, 96,600 cubic yards of concrete, 30,500 pounds of reinforcement, and 782 tons of structural steel. Unique features included the use of the vertical lift gate at the upper end of the chamber, considered "rare in American lock construction." Culverts were also built inside the lock walls for filling and emptying operations rather than the more usual location in the lock floor. Since the culverts were in the chamber wall, the floor consisted simply of "a thin concrete paving over the solid rock bottom."[42]

Green & Sons had also been awarded the contract for the concrete work at Marseilles Lock and Dam, so they simply moved their plant and equipment from that site to Lockport. The layout of the Lockport site required placing all the equipment at the east end, which was further constrained by the Santa Fe Railway and Deep Run Creek. The available land only measured 2,000' long x 250' wide, plus area gained by filling in the creek. The plant consisted of cableway tracks located on the filled-in Deep Run Creek and the west bank of the Des Plaines River that crossed over the lock site. On the east bank of the river were the mixing plant and stockpiles. Another track system extended from the Santa Fe Railway's railroad tracks, under the cableway and into the lock pit, where derricks were located.[43]

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[39] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 95-96.
[40] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 83-90.
[41] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 2, pp. 75-81.
[42] "Lockport Lock Construction Plant, Illinois Waterways," *Engineering News-Record* 96, no. 6 (February 11, 1926): p. 228.
[43] "Lockport Lock Construction Plant," p. 229. The cableway's dimensions were as follows: the head tower was 135' tall and the tail tower was 85' tall. The cableway spanned 916' and had a working load of 16 tons and a capacity of 30 tons, see p. 230.

The first step in building the lock was to excavate the rock by channeling and drilling into it with 70-C and 20-B steam shovels. Equipment used to drill included "channelers, drills in pairs on quarry bars for deep holes, jackhammers for lighter work, a central compressor plant, portable compressors and drill sharpeners." Excavation began at the east wall and continued out across the lock. When enough of the lock foundation had been cleared, the concrete work started with great care taken around the deteriorating original lock.[44]

Green & Sons used a belt conveyor leading from the gravel trestle to a bucket elevator to carry the gravel to the bin located above the mixers. A similar system was used to move the cement from the railroad cars to the mixers, which were 1 cubic yard (cu yd) units. Once the materials had been mixed, the concrete was emptied into cars equipped with 7 cu yd buckets that were then moved to the cableway. The buckets were next picked up and moved into position for pouring. The standard wood forms were 30' long, and the concrete was poured in alternate sections because the contract prohibited "chuting."[45]

The lift gate at Lockport was described in another 1926 article in the *Engineering News-Record*. Space constraints at the site as well as the high lift necessitated the use of vertical lift gates at the lock's upstream end. Engineers decided plate girders would not be economical for the gates and instead chose trusses "with a buckle plate skin on the upstream side" instead. In addition, the traditional lift gate design of having the gates move "horizontally into a recess in the side wall to open the lock" was not used because it would require construction of a high concrete wall. Instead, the Stoney gate-type (counterweighted rising gate) was chosen. This design had the added benefit of being easier to inspect and repair since the gate could be lifted entirely out of the water. Two vertical lift gates were built, one of which was in operation while the other was called a "guard gate" (also known as the emergency gate) and was usually "in the lowered position behind the sill wall."[46] An overhead bridge spanning the chamber between two steel towers located on the lock walls contained the operating equipment. The counterweighted gates were operated by cast steel sprocket wheels with a chain, "one end being attached to the upper corner of the gate and the other in a heavy concrete counterweight traveling in guides in the tower." A motor on the overhead bridge operated the wheels.[47] Other unique features of the lift gates that were detailed in the article included shock absorbers of cast steel with an inner steel cylinder that were located at the lower corners of the gates. There was also a groove in the downstream sill edge into which a wrought iron pipe was inserted to help create a

[44] "Lockport Lock Construction Plant," p. 230.
[45] "Lockport Lock Construction Plant," p. 229-234.
[46] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 1, p. 71.
[47] Walter M. Smith, "Heavy Lift Gate at Lockport Lock of Illinois Waterway," *Engineering News-Record* 96, no. 18 (May 26, 1926): pp. 722-723.

seal when the gates were lowered. Finally, a flushing system of cast and wrought iron pipes washed out mud and debris from the cover plates.[48]

When the Army Corps assumed authority over the waterway in 1930, reportedly 97 percent of the site had already been completed by the state, with work remaining on the miter gate, auxiliary structures and the control station. The Army Corps contracted William Grohne Company of Joliet in 1932 to build six frame buildings to protect machinery that was exposed to the elements.[49] Schmidt Brothers Construction Company of Chicago built the brick control station from 1931-33.[50] (See Appendix A, Figure 3) Other buildings constructed on the site included two identical frame lockkeepers' houses with gable roofs and chimneys and a garage/storehouse in 1939 by the Biggs Construction Company of Chicago.[51] (See Appendix A, Figure 4) The Army Corps contracted installation of the control and indicating equipment, lock signals, exterior illuminating equipment, gallery recess and shelter illuminating equipment, and installation of cables, connection boxes, and "other appurtenances" to the Wadeford Electric Company of Chicago in 1933.[52]

The state had not installed the operating machinery at the time of the transfer of authority so the Army Corps oversaw that work. The culvert valve equipment, which came from the Mississippi Valley Structural Steel Company, was installed in 1933.[53] Modifications and repairs also had to be made to the original construction. In the winter of 1933, the Army Corps drained the lock and contracted Paschen Brothers Construction Company of Chicago to repair the lock valves and to replace the pins and pintles on the miter gate hinge assemblies. In February, the contractor reflooded the lock chamber after completing the contract.[54]

The lower miter sills had to be redesigned by the Army Corps in 1932 because the original design "appeared to have not allowed for possible upward water pressure between the rock and concrete." Since the lock chamber had already been constructed, the Army Corps contracted the Powers-Thompson Construction Company of Joliet to strengthen the sills by "drilling the floor above the lower miter sill to relieve the pressure" and then "drilling diagonal holes through the concrete and into the rock,

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[48] Smith, "Heavy Lift Gate," p. 723.
[49] Folder 821.1 (Lockport, Marseilles, & Starved Rock Locks) Machinery Shelters W-1088-Eng-243, in U.S. Army Corps of Engineers, Chicago District, RG 77, NARA, Chicago.
[50] Folder 821.1 (Marseilles, Starved Rock, Lockport) Wells and Control Houses W-1088-Eng-302, 1931-33, in U.S. Army Corps of Engineers, Chicago District, RG 77, NARA, Chicago.
[51] Folder 624 (Lockport & Dresden Island) W-1088-Eng-1229 (1939) in U.S. Army Corps of Engineers, Chicago District, RG 77, NARA, Chicago. Image available at Lockport Lock site, dating to September 25, 1939 and showing the houses under construction.
[52] Folder 821.1 (Marseilles-Starved Rock-Lockport) Electrical Equipment W-1088-Eng-309 1931-32 and 1932-33 and Folder 821.1 (Marseilles-Starved Rock-Lockport) Electrical Equipment W-1088-Eng-309, 1931-33, all in U.S. Army Corps of Engineers, Chicago District, RG 77, NARA, Chicago.
[53] Folder 821.13 (Lockport-Gate Valve) W-1088-Eng-710, 1933, in U.S. Army Corps of Engineers, Chicago District, RG 77, NARA, Chicago.
[54] Folder 821.1 (Lockport Lock) Alterations & Repair, W-1088-Eng-624, 1933-34, in U.S. Army Corps of Engineers, Chicago District, RG 77, NARA, Chicago.

inserting heavy bolts, grouting the bolts into the rock and then placing the bolts under an initial tension of 23,000 pounds per bolt."[55] (See Appendix A, Figure 2)

Tow haulage units manufactured by the American Heist & Derrick Company were installed at the lock in the late 1930s. Capt. R.L. Dean, Assistant to the Division Engineer noted in a 1937 memo that he noticed at Starved Rock how a lack of power tow haulage units made "hand towing" necessary during double lockages. He went on to remark, "in view of the tremendous increase in Illinois River traffic in recent years, with a corresponding increase in number of lockages which must also include an increase in double lockages, inquiry is made as to whether installation of power tow-haulage units at such lock as are now without them is not now economically justified."[56] These were later replaced in the 1970s with more modern units.

Various auxiliary buildings have been construction and alterations have been made to the operating machinery throughout the site's operational history.

C. Operation:

The Illinois Waterway had originally been designed for use by "towboats pushing eight jumbo hopper barges." The jumbo barges each measured 35' x 195'. The configuration of the eight barge tow with a towboat consisted of two rows of three barges tied together followed by a row of two barges tied together. The towboat pushed the three rows into position in the lock chamber, then moved alongside the first row (made up of two barges) during the lockage. The resulting configuration measured 105' x 600', which allowed all the barges to be locked though in one pass since the lock chamber conformed to the Ohio River Standard of 110' x 600'. By the 1950s, the fourteen barge tow had become the standard. While the Thomas J. O'Brien lock with its 110' x 1000' chamber could handle this larger tow configuration, the earlier locks could not. The fourteen barge tow measured 105' x 985', requiring that the tow be broken into two, known as "cuts," on the other locks. The first cut was made up of two rows of three barges tied together. The second cut followed the standard configuration used in the eight barge tow. Rathburn describes the locking through process with the fourteen barge two configuration.

> After breaking the two into these two cuts, the towboat pushed the first cut of barges through the lock, locked through with it, pushed the cut out of the lock, locked back through to get the second cut of barges, pushed it into the lock, moved over into the 'third barge slot' in the last row of the eight-barge configuration, locked through with the second cut, and then

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[55] Folder 285/68b (Ill Wwy) State of Illinois 1932-49, File #5; C.R. Andrew, Principal Engineer to District Engineer, Memo: Field Operations, Illinois Waterway, January 23, 1932, p. 6 in Folder 285/68b (Ill Wwy) State of Illinois 1929, File #4, both in U.S. Army Corps of Engineers, Chicago District, RG 77, NARA, Chicago.

[56] R.L. Dean, Capt, Corps of Engineers Assistant to Division Engineer to The District Engineer, Subject: Power tow-haulage units, September 11, 1937, in Folder 821.13 (Locks-Machinery), in U.S. Army Corps of Engineers, Chicago District, RG 77, NARA, Chicago.

reassembled the two cuts into one united configuration and moved back into its pushing position.[57]

This process was time consuming and caused congestion along the waterway, so the Army Corps installed replacement tow haulage units in the 1970s at all the locks except Thomas J. O'Brien. These units allowed the first cut to be pulled through the lock without the towboat, which remained in its position in the second cut. This minimized some of the time spent locking through. The installation of the new tow haulage units facilitated the use of seventeen barge tow configurations, measuring 105' x 1118'. In this configuration, the first cut is made up of three rows of three barges. The second cut has two rows of three barges while the last row has two barges and an open slot for the towboat.[58]

From the 1930s to the 1970s, the amount and size of the vessels using the Illinois Waterway increased. In 1934, commercial traffic on the waterway amounted to 104,750 tons and had increased by 1953 to 20 million.[59] Traffic on the waterway leveled in the 1970s but congestion on both the Illinois Waterway and the Upper Mississippi River continues. The Upper Mississippi River-Illinois Waterway, according to a recently released study of the two systems, in 2005, 51.6 million tons of commercial cargo worth $9.5 billion was transported on the Illinois Waterway.

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[57] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 1, p. 99.
[58] Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 1, pp. 100-102.
[59] Department of Public Works & Buildings, "132 Years of Public Service: The History and Duties of the Division of Waterways," (State of Illinois, 1955), p. 15.
Illinois Waterway traffic statistics are provided in the U.S. Army Corps of Engineers' Annual Reports. The information is presented in various ways throughout the 1930s. In 1931, the upbound traffic on the Illinois River (from La Salle to Grafton, IL) consisted of 128 steamers, 609 motor vessels, 21 sailing vessels, and 457 barges for a total of 1,215 vessels. The downbound traffic included 140 steamers, 515 motor vessels, 21 sailing vessels, and 400 barges for a total of 1,076 vessels. (USACE, *Annual Report*, Part II, 1932, p. 696.) By 1933, traffic had increased to a total of 2,140 upbound vessels at 341,760 tons, consisting of 50 steamers, 1,251 motor vessels, 772 barges, and 67 other types. Downbound traffic numbered 2,290 vessels at 344,249 tons, including 50 steamers, 1,282 motor vessels, 756 barges, and 202 other types. In 1934, the total numbers of vessels had declined but the tonnages increased, with upbound tonnage at 642,715 and downbound at 682,214. (USACE, *Annual Report*, Part II, 1934, p. 670 and Part II, 1935, p. 710.) In 1935, the statistics for the Illinois Waterway also included the Chicago Sanitary & Ship Canal and the Calumet-Sag Canal. The total tonnage was 1,361,280. On the South Branch of the Chicago River, 215,107 tons were carried. Total tonnage, including rafted traffic, was 1,584,428 tons worth $48,710,394. (USACE, *Annual Report*, Part II, 1936, p. 747.) In 1936, 1,537,759 tons were transported on the Illinois Waterway and 507,805 tons were moved on the South Branch of the Chicago River. The total tonnage was 2,048,057, including rafted traffic, for a total value of $54,725,585. (Army Corps, *Annual Report*, Part II, 1937, p. 781.) In 1937, 2,874,864 tons were transported on the Illinois Waterway and 698,329 tons on the South Branch of the Chicago River. The total tonnage, plus rafted traffic, equaled 3,575,299 tons worth $65,604,398. (USACE, *Annual Report*, Part II, 1938, p. 803.) By 1938, the total tonnage on the Illinois Waterway (which included the Chicago Sanitary & Ship Canal, Calumet-Sag Canal, and South Branch of the Chicago River) was 4,446,493, including rafted traffic, at a total worth of $109,008,794. (USACE, *Annual Report*, Part II, 1939, p. 863). From 1975-86, the amount of goods shipped on the waterway decreased from 48.5 million to 42.3 million. (Rathburn, "Architectural and Engineering Resources of the Illinois Waterway," Volume 1, p. 103).

Together the two systems move 60 percent of corn exports and 45 percent of soybean exports, in addition to coal, chemicals and petroleum.[60]

The Lockport Lock, Dam and Power House site is significant both for its role in navigation of the Chicago Sanitary and Ship Canal and the Illinois Waterway and for the vertical lift lock gate at the upstream end of the lock. The Lockport vertical lift gate was declared in the *Chicago Daily Tribune* to be the "highest lift lock in the world of that size" in 1928 and may be the only one of its kind still in operation according to a 1996 inventory and a 2001 National Register nomination.[61]

Part III. Sources of Information

A. Primary Sources

"70 Chicagoans Inspect Locks in Illinois River." *Chicago Daily Tribune*, October 5, 1928, p. 3.

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U.S. Engineer Office, Chicago District, Joliet Area, "Illinois Waterway, Lockport Lock, Topography," December 1935.

[60] See Final Draft, "Re-Evaluation of the Recommended Plan: UMR-IWW System Navigation Study, Interim Report," issued March 2008, available at http://www2.mvr.usace.army.mil/UMRS/NESP/ (accessed March 2009).
[61] "70 Chicagoans Inspect Locks in Illinois River," *Chicago Daily Tribune*, October 5, 1928, p. 3.

B. Secondary Sources

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C. Likely Sources Not Yet Investigated

Research was conducted in the Army Corps of Engineers records at the National Archives and Records Administration, Great Lakes Region, Chicago, but time constraints prevented thorough research of all records. Additional information may be available in the records.

The State of Illinois' archives in Springfield, Illinois, contain the Annual Reports of the Division of Waterways, which would provide more information on the state's construction. This archive was consulted during the research for the 1996 overview and inventory produced by American Resources Group with Mary Yeater Rathburn as Principal Investigator.

Appendix A: Images

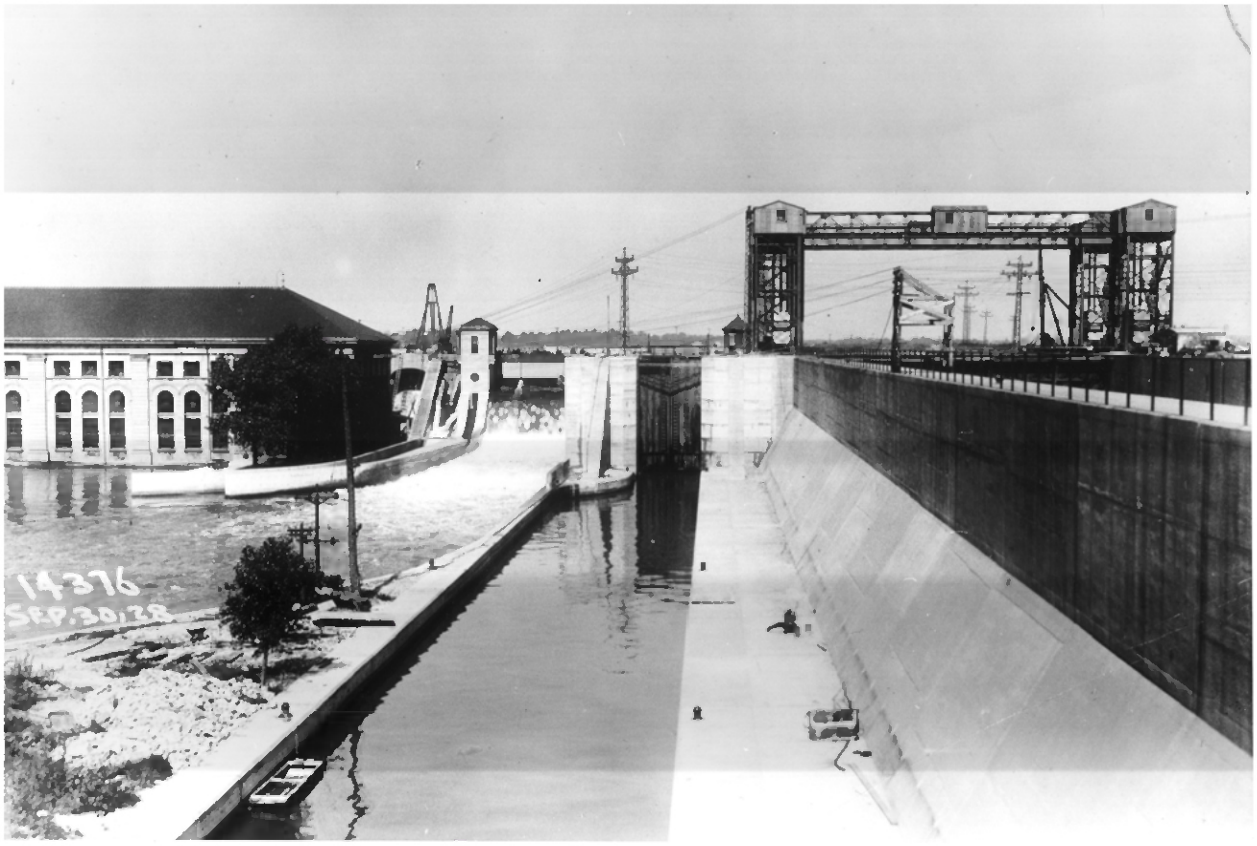

Figure 1: Photograph shows power house at left with original lock in center and new lock at right, September 30, 1928. Available at Lockport Lock and Dam.

Figure 2: Lockport Lock alterations, March 22, 1932. Caption on back reads: "View looking northwest or upstream showing earth cofferdam constructed across lower end of lock chamber for lock alterations to lower gate sills; lower lock gates and lower end of river wall and stairs, and pumps in place for unwatering cofferdam." Available at Lockport Lock and Dam.

Figure 3: U.S. Engineer Office, First Chicago District, Lockport Lock, Control House, May 16, 1932. Caption on back reads: "View looking north from land wall of lock showing completed control house for lock. Landwall in fore-ground, and lifting tower and bridge for upper lock gates in background." Available at Lockport Lock and Dam.

Figure 4: Biggs Construction Company, Dwellings: Lockport Lock, September 25, 1939. Available at Lockport Lock and Dam.